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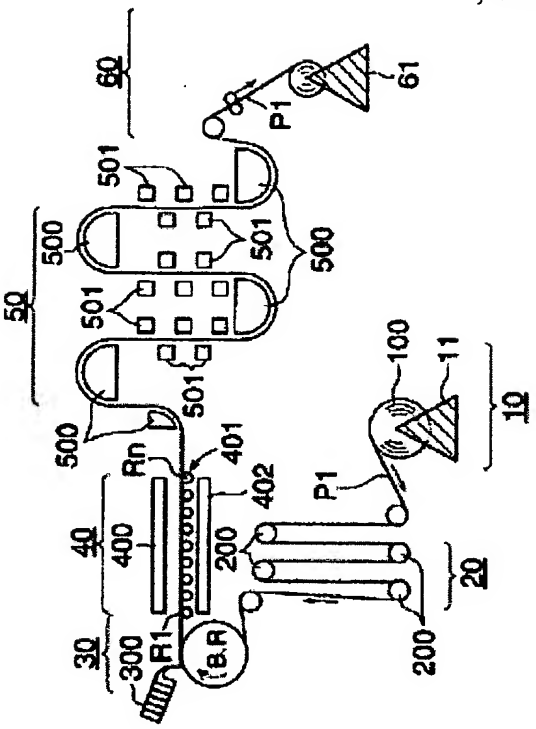

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(54) [Title of invention] Simultaneous multilayer coating method, photosensitive material produced by using this method and photosensitive material producing device using this method

(57) [Summary]
[Problems] To provide with a simultaneous multilayer coating method that allows stably coated surfaces in coating more than 10 layers simultaneously while using a carrier having an unevenness of about 10 μm or while using a carrier that creates unevenness easily and a photosensitive material produced by using the method. To provide with a photosensitive material producing device that can form a more stably coated surface by improving the carrier transportation configuration immediately after coating.
[Means for solving problems] Simultaneous multilayer coating method wherein in simultaneously coating a coating solution on more than 10 layers on a continuously running carrier, coating is done while controlling the viscosity of the coating solution forming the lowest layer to be 50 cP~300 cP and the arithmetic average viscosity of the coating solution forming multiple layers of more than 9 layers over the above-said lowest layer to be 50 cP~1,000 cP.
[Scope of claims]

[Claim 1] Simultaneous multilayer coating method wherein in simultaneously coating a coating solution over more than 10 layers on a continuously running carrier, the viscosity of the coating solution forming the lowest layer is controlled to be 50 cP~300 cP and the arithmetic average viscosity of the coating solution forming more than 9 multiple layers over the above-said lowest layer is controlled to be 50 cP~1,000 cP.
[Claim 2] The simultaneous multilayer coating method of Claim 1 wherein a curtain coating device having a slide surface is used as a coating device.
[Claim 3] The simultaneous multilayer coating method of Claim 1 or Claim 2 wherein the coating solution forming the above-said lowest layer is a coating solution having the gelatin concentration greater than 5 %.
[Claim 4] The simultaneous multilayer coating method of any of Claims 1~3 wherein the total coated film thickness is less than 270 mm in wet film thickness.
[Claim 5] The simultaneous multilayer coating method of any of Claims 1~3 wherein the above-said coating solution is a coating solution for a photosensitive material.
[Claim 6] Photosensitive material produced by drying after simultaneously coating multiple layers by supplying a coating solution for a photosensitive material on a continuously running carrier while controlling the viscosity of the coating solution forming the lowest layer to be 50 cP~300 cP and the arithmetic average viscosity of the coating solution forming more than 9 multiple layers over the above-said lowest layer to be 50 cP ~1,000 cP.
[Claim 7] The photosensitive material of Claim 6 in which the above-said carrier is a cellulose triacetate.
[Claim 8] The photosensitive material of Claim 6 or Claim 7 in which a means of using a curtain having a slide surface is used as the means of simultaneous multilayer coating.
[Claim 9] Photosensitive material producing device constructed from a slide curtain coating device that simultaneously coats a coating solution over a running carrier while controlling the viscosity of the coating solution forming the lowest layer to be 50 cP~300 cP and the arithmetic average viscosity of the coating solution forming more than 9 multiple layers over the above-said lowest layer to be 50 cP~1,000 cP and a transporting means constructed from a multiple number of rollers installed in a line form that loads and transports the above-said carrier immediately after coating, and a controlling means that maintains the wrap angle of the above said carrier with respect to the above-said rollers at 5 degrees to 90 degrees.
[Claim 10] The photosensitive material producing device of Claim 9 wherein the above-said controlling device contains a cold air-giving device that gives cold air to the coated surface of the above-said carrier and the suctioning device that acts on the coated surface and the opposite surface of the above-said carrier.
[Detailed explanation of invention]
[0001]
[Area of technology of invention] The present invention relates to a simultaneous multilayer coating method and a photosensitive material produced by using this method and a photosensitive material producing device using this method.
[0002]
[Conventional technology]

Cellulose triacetate film, polyethylene terephthalate film or paper laminated with polyethylene have conventionally been used as carriers for photosensitive materials and simultaneous multilayer coating techniques have been used in devices or methods for producing color photosensitive materials.

[0003] On the other hand, in order to obtain products having stable quality, coating a coating solution for a photosensitive material comprising a hydrophilic colloid solution containing gelatin or its derivatives (referred to as photoemulsion hereinafter) and coating evenly by forming layers of photoemulsion layers obtained by drying them have been sought.

[0004] However, especially when cellulose triacetate film is used as the carrier, unevenness of the film produced occurs easily in the film production stage, the photoemulsion coated on such an uneven carrier is easily influenced by the unevenness of the above-said carrier, causing coat nonuniformity corresponding to the unevenness of the carrier (referred to as the carrier unevenness nonuniformity).

[0005] In addition, the solution/solution surface number increases with the increase in the total number of coats, causing irregularities on the surfaces and coat unevenness vertically along the slide surface (coat nonuniformity in a wave form in the direction of the width of the coat of the carrier, referred to simply as vertical nonuniformity hereinafter).

[0006] The former is caused by the leveling phenomenon of the coating solution and the latter is caused by unstable multilayer flow on the slide surface of the coating device.

[0007] Increasing the viscosity of the coating solution is considered as a measure against the above-said problems. Since the viscosity of the coating solution for forming the lowest layer especially controls the above-said leveling phenomenon, increasing its viscosity is effective.

[0008] A method for producing a color photosensitive material based on such an increased viscosity of the coating solution has been published in Disclosed Patent Announcement number Hei3-219237.

[0009] Specifically, a method for producing a color photosensitive material coating while controlling the viscosity of the coating solution for the lowest layer contiguous with the carrier to be 15 cP~100 cP and the viscosity of the coating solution of more than 7 layers over the above said lowest layer to be higher than 30 cP, and the arithmetic average of the viscosity of the coating solution of the above-said more than 7 layers to be 60~300 cP has been published.

[0010] It has been reported that good coating can be done on a surface even if it has a maximum of 5 μm unevenness by this method.

[0011]

[Problems solved by invention] However, unevenness occurs easily immediately after coating, causing coating nonuniformity when there is almost no unevenness on the carrier before coating when cellulose triacetate film is used as the carrier.

[0012] In addition, a transport means of the configuration of a multiple number of rollers arranged in a line form is usually used as the means of transporting the carrier immediately after coating.

[0013] If the above-said carrier is loaded and transported over such a transport device, trouble occurs (unevenness in the width direction of the carrier) in the part not supported

by the rollers (free span area) while the part supported by the rollers maintains the smoothness.

[0014] The above-said unevenness frequently reaches a pitch (measurements between adjoining mountains or valleys) of about 7 mm~15 mm and an amplitude (measurements between a mountain top and a valley bottom) of about 100 μm~30 μm when the carrier film thickness is about 120 μm and the coated layers are 8~15 (with a wet film thickness of about 100 μm~240 μm).

[0015] Thus, the viscosity value of the coating solution is increased as in the above-said patent announcement when a transport device is involved immediately after coating, and even if even coating is obtained by using a slide bead coating device, obtaining photosensitive material having good quality is difficult.

[0016] The above-said method in the above-said patent announcement is not sufficient even when the wet film thickness is as thick as about 250 μm or 270 μm.

[0017] The above-said slide bead coating method proposed in the above-said patent announcement has a certain number of limitations in the coating solution conditions of the lowest layer, especially with respect to coating when the viscosity is increased.

[0018] The inventors of the present invention, have obtained as a result of conducting various experiments, various findings on the relationships between the cellulose triacetate film and coating, and have discovered that the viscosity of the coating solution of the lowest layer can be increased with the slide curtain coating method, and that the lower limit of the viscosity of the coating solution forming the lowest layer corresponds to the lower limit of the occurrence of the above-said leveling phenomenon and the upper limit is the viscosity that does not allow coating etc.

[0019] In addition, the lower limit of the viscosity of the coating solution of other layers layered sequentially over the lowest layer is the lower limit of the occurrence of vertical coating nonuniformity of the slide surface and the lower limit of the occurrence of the leveling phenomenon and the upper limit is related only with the slide curtain coating method and corresponds to the viscosity until the curtain film becomes unstable.

[0020] The goal of the present invention is to resolve the problems of the conventional technology and to provide with a simultaneous multilayer coating method that allows obtaining a stably coated surface even when a carrier having an unevenness of about 10 μm or a carrier causing unevenness easily is used in coating more than 10 layers simultaneously and a photosensitive material produced by using this method.

[0021] In addition, another goal of the present invention is to provide with a photosensitive material producing device that can form a more stably coated surface by improving the configuration of the carrier transport immediately after coating.

[0022]

[Means for solving problems] The goals of the present invention can be accomplished by the configuration described below.

[0023] (1) Simultaneous multilayer coating method wherein coating in coating simultanesouly a coating solution on more than 10 layers on a continuously running carrier is done while controlling the viscosity of the coating solution forming the lowest layer to be 50 cP~300 cP and the arithmetic average viscosity of the coating solution forming more than 9 layers layered above the lowest layer to be 50 cP~1,000 cP.

[0024] (2) The simultaneous multilayer coating method of the above-said (1) wherein a curtain coating device having a slide surface is used as the coating device.

[0025] (3) The simultaneous multilayer coating method of the above-said (1) or (2) wherein the coating solution forming the above-said lowest layer is a coating solution having the gelatin concentration higher than 5 %.
[0026] (4) The simultaneous multilayer coating method of any of the above-said (1)~(3) wherein the total coated film thickness is less than 270 μm in wet film thickness.
[0027] (5) The simultaneous multilayer coating method of any of the above-said (1)~(4) wherein the above-said coating solution is a coating solution for a photosensitive material.
[0028] (6) Photosensitive material produced by simultaneously coating multiple layers by supplying a coating solution for a photosensitive material with the viscosity of the coating solution forming the lowest layer adjusted at 50 cP~300 cP and the arithmetic average viscosity of the coating solution forming more than 9 layers layered over the above-said lowest layer adjusted at 50 cP~1,000 cP over a continuous running carrier and drying the coated layers.
[0029] (7) The photosensitive material of the above-said (6) wherein the above-said carrier is cellulose triacetate film.
[0030] (8) The photosensitive material of the above-said (6) or (7) wherein a curtain coating device having a slide surface is used as the simultaneous multilayer coating device.
[0031] (9) Photosensitive material producing device comprising a slide curtain coating device that simultaneously coats a coating solution on a running carrier while adjusting the viscosity of the coating solution of the lowest layer to be 50 cP~300 cP and the arithmetic average viscosity of the coating solution forming more than 9 layers layered above the above-said lowest layer to be 50 cP~1,000 cP, a transporting device constructed from a multiple number of rollers arranged in a line form that loads and transports the above-said carrier immediately after coating and a controlling device that controls the wrap angle of the above-said carrier with respect to the above-said rollers to be 5 degrees to 90 degrees.
[0032] (10) The photosensitive material producing device of the above-said (9) comprising a cool air giving device that gives cool air to the coated surface of the above-said carrier and a suctioning device that acts on the coated side and the opposite side of the above-said carrier.
[0033]
[Embodiment of invention] Although an example of the embodiment of the present invention is presented below with figures, the present invention is not limited to or by this example.
[0034] Figure 1 shows an outlining diagram of the entirety of the photosensitive material producing device of the present invention.
[0035] In the figure, 10 is a supplying part, where a stock or original roll 100 that rolls the carrier for the photosensitive material of cellulose triacetate film (referred to simply as a carrier or web hereinafter) P1 is installed.
[0036] 20 is an accumulator constructed from a multiple number of transporting rollers, and B.R. is a backup roller.
[0037] 30 is a coater having a coating device that coats the coating solution for the photosensitive material or a photoemulsion, and the said coating device is constructed

from a slide curtain coating device 300 (referred to simply as the curtain coating device hereinafter) that can coat simultaneously multiple layers of more than 10 layers.
[0038] Coating is done on the above-said carrier P1, which is in a stable state, on the above-said backup roller B.R.
[0039] The curtain coating technique is well known as described in the Detailed Description sections of American Patent Numbers 632374 and 4569863.
[0040] 40 is a setting part that sets the coating solution in gel form by applying cool air to the coated layer immediately after coating in order to prevent fluidization of the coated solution applied by the above-said coater.
[0041] Thus, the above-said setting part is equipped with a cool air generator 400 that gives cool air to the coated surface of the above-said carrier P1, a transporting device 401 of multiple rollers (R1~Rn) for transporting the above-said carrier, and a suctioning device 402 that suctions the atmospheric air of the uncoated side of the above-said carrier.
[0042] 50 is a dryer of hot air for drying by eliminating moisture from the above-said web P1 after passing the above-said setting part 40, which has a multiple number of reversers 500 and floaters 501 for changing the direction of transportation, which is constructed to perform drying, noncontiguously with the above-said carrier.
[0043] 60 is a rolling or takeup part that has a rolling device 61.
[0044] It is desirable to install the accumulator between the above-said takeup part 60 and the above-said dryer 50.
[0045] The above-said rolling device 61 is run by a running device that is controlled appropriately, where the coated and dried above-said web or web P1, which has become photosensitive material, is loaded on a removable spool (not shown in figures) installed on the said rolling device.
[0046] The operation of the production device of the configuration described above is as follows.
[0047] The original rolled web P1 is set in the supplying part and its beginning part is rolled on the rolling device to begin the process.
[0048] The coating part 30 having a slide curtain coating device coats the photoemulsion simultaneously on multiple layers, on the continuously running above-said carrier P1, loads the above-said carrier on the transporting device 401, which comprises rollers installed on the setting part 40, gives cool air of 3~7 degrees Celsius to the coated surface of the above-said carrier from the cool air generator 400 in the transporting process of the said rollers, gels and solidifies the coating solution (photoemulsion).
[0049] The above-said suctioning device 402 functions as one of the means of maintaining the wrap angle of the carrier with respect to the above-said roller surface in a certain range. Another major factor forming the above-said wrap angle is the tension of the carrier.
[0050] A desired dry state is obtained by eliminating moisture that includes the above-said photoemulsion by hot air in the drying part 50, the coated carrier is wound in a roll form on the spool of the reeling device 61 to obtain the photosensitive material.
[0051] Figure 2 shows an outline of the relationships between a part of the rollers (transporting device) 401 of the above-said setting part and the carrier.
[0052] It has been verified from various experiments that the above-said problem of the occurrence of the unevenness of the carrier immediately after coating is due to the wrap

angle of the carrier with respect to the rollers (the angle pulled by both ends of the roller outer circumference surface that the carrier is in contact with from the roller center) and in the above-said configuration, the above-said wrap angle is maintained within a specific range.

[0053] The above-said wrap angle (α) is in the range of 5 degrees $\leq \alpha \leq$ 90 degrees desirably, 10 degrees $\leq \alpha \leq$ 80 degrees more desirably, and 30 degrees $\leq \alpha \leq$ 60 degrees most desirably.

[0054] In addition, it is desirable to shorten the above-said free span length, together with the above-said wrap angle, as much as possible.

[0055] As a method of shortening the above-said free span length, it is desirable to make the closest space between neighboring rollers on the outer circumference surface (distance) about 1 mm to 5 mm.

[0056] In addition, the free span length is directly related to the roller diameter, and rollers of diameters of about 50 mm~100 mm are desirable for all practical purposes.

[0057] The above said rollers can be rollers of shapes of varying diameters along the edge from the center of the width direction of the carrier, specifically appropriate numbers of crown shaped rollers and/or reverse crown shaped rollers (refer to Figure 3). Positionally, the position where the carrier initially touches (is loaded) immediately after being coated or the anterior number 1 position in the above-said setting part is desirable.

[0058] The above-said wrap angle can be ensured by the cool air generator 400 and by reinforcing the suctioning conditions of the above-said suctioning device and controlling the tension of the carrier.

[0059] In the embodiment, the above-said cool air was set to be 0.5 mmAq (blow out differential pressure), and suctioning was set at 60 mmAq (suctioning differential pressure).

[0060] A tenter can used additionally in the above-said configuration of the transporting part.

[0061] Specifically, a means that works endlessly to squeeze the two side edges of the carrier loaded in the above-said transporting device and releases the above-said squeezing, giving some widths at specific distances may be used in the above-said configuration.

[0062] A belt that has a width wider than the width of the carrier can be used as a transporting device 401 as a variation of the above-said transporting device 401 constructed from rollers.

[0063] This case is very desirable since the above-said free span area can be eliminated and thus the smoothness of the carrier can be preserved.

[0064] The above-said tenter can be also used in this case.

[0065]

[Examples] The effects of the present invention are verified with examples below.

[0066] Ten and 15 layers are used as coated layers in the examples given below.

[0067] The amount of the composite added is shown as the number of grams per m^2 unless indicated otherwise.

[0068] In addition, silver halide and colloidal silver are shown in silver conversions. The sensitizing dyes are shown in moles per mole of silver halide.

[0069] In addition, the viscosity was controlled by an aqueous tackifier having styrene and sodium maleate copolymer as the main ingredient.

[0070]
(case of 10 layers)

Layer 1: halation preventive layer	
black colloidal silver	0.16
UV absorbent (UV-1)	0.20
high boiling point solvent (Oil-1)	0.16
gelatin	1.23
Layer 2: first red sensitive layer	
silver iodobromide emulsion (with average particle size of 0.38 μm and silver iodide contents of 8.0 mole %)	0.50
(with average particle size of 0.27 μm and silver iodide contents of 2.0 mole %)	0.21
sensitizing dye (SD-1)	2.8×10^{-4}
sensitizing dye (SD-2)	1.9×10^{-4}
sensitizing dye (SD-3)	1.9×10^{-5}
sensitizing dye (SD-4)	1.0×10^{-4}
cyan coupler (C-1)	0.48
cyan coupler (C-2)	0.14
colored cyan coupler (CC-1)	0.021
DIR compound (D-1)	0.020
high boiling point solvent (Oil-1)	0.53
gelatin	1.30
Layer 3: second red sensitive layer	
silver iodobromide emulsion (with average particle size of 1.00 μm and silver iodide contents of 8.0 mole %)	1.27
cyan coupler (C-2)	0.12
colored cyan coupler (CC-1)	0.013
high boiling point solvent (Oil-1)	0.14
gelatin	0.91
Layer 4: intermediate layer	
compound (SC-1)	0.09
high boiling point solvent (Oil-2)	0.11
gelatin	0.80
Layer 5: first green sensitive layer	
silver iodobromide emulsion (with average particle size of 0.38 μm and silver iodide contents of 8.0 mole %)	0.61
silver iodobromide emulsion (with average particle size of 0.27 μm and silver iodide contents of 2.0 mole %)	0.20
sensitizing dye (SD-4)	7.4×10^{-5}
sensitizing dye (SD-5)	6.6×10^{-4}
magenta coupler (M-1)	0.18

magenta coupler (M-2)	0.44
colored magenta coupler (CM-1)	0.12
high boiling point solvent (Oil-2)	0.75
gelatin	1.95

Layer 6: second green sensitive layer

silver iodobromide emulsion (with average particle size of 1.00 μm and silver iodide contents of 8.0 mole %)	1.27
sensitizing dye (SD-6)	9.4×10^{-5}
sensitizing dye (SD-7)	9.4×10^{-5}
sensitizing dye (SD-8)	9.4×10^{-5}
magenta coupler (M-2)	0.084
magenta coupler (M-3)	0.064
colored magenta coupler (CM-2)	0.012
high boiling point solvent (Oil-1)	0.27
high boiling point solvent (Oil-2)	0.012
gelatin	1.00

Layer 7: yellow filter layer

yellow colloidal silver	0.08
color stain preventing agent (SC-2)	0.15
formalin scavenger (HS-1)	0.20
high boiling point solvent (Oil-2)	0.19
gelatin	1.10

Layer 8: first blue sensitive layer

silver iodobromide emulsion (with average particle size of 0.38 μm and silver iodide contents of 8.0 mole %)	0.22
silver iodobromide emulsion (with average particle size of 0.27 μm and silver iodide contents of 2.0 mole %)	0.03
sensitizing dye (SD-9)	4.2×10^{-4}
sensitizing dye (SD-10)	6.8×10^{-5}
yellow coupler (Y-1)	0.75
DIR compound (D-1)	0.010
high boiling point solvent (Oil-2)	0.30
gelatin	1.20

Layer 9: second blue sensitive layer

silver iodobromide emulsion (with average particle size of 1.00 μm and silver iodide contents of 8.0 mole %)	0.85
sensitizing dye (SD-9)	7.3×10^{-5}
sensitizing dye (SD-11)	2.8×10^{-5}
yellow coupler (Y-1)	0.11
high boiling point solvent (Oil-2)	0.046
gelatin	0.80

Layer 10: protective layer

alkali soluble matting agent (with average particle size of 2 μm) 0.15

polymethyl methacrylate (with average particle size of 3 μm) 0.04

slipping agent (WAX-1) 0.04

gelatin 0.55

Su-1 0.02

Su-2 0.03

H-1 0.024

H-5 0.046

H-9 0.010

(case of 15 layers)

Layer 1: halation preventive layer

black colloidal silver 0.16

UV absorbent (UV-1) 0.20

high boiling point solvent (Oil-1) 0.16

gelatin 1.23

Layer 2: intermediate layer

compound (SC-1) 0.15

high boiling point solvent (Oil-2) 0.17

gelatin 1.27

Layer 3: first red sensitive layer

silver iodobromide emulsion (with average particle size of 0.38 μm and silver iodide contents of 8.0 mole %) 0.50

(with average particle size of 0.27 μm and silver iodide contents of 2.0 mole %) 0.21

sensitizing dye (SD-1) 2.8×10^{-4}

sensitizing dye (SD-2) 1.9×10^{-4}

sensitizing dye (SD-3) 1.9×10^{-4}

sensitizing dye (SD-4) 1.0×10^{-4}

cyan coupler (C-1) 0.48

cyan coupler (C-2) 0.14

colored cyan coupler (CC-1) 0.021

DIR compound (D-1) 0.020

high boiling point solvent (Oil-1) 0.53

gelatin 1.30

Layer 4: second red sensitive layer

silver iodobromide emulsion (with average particle size of 0.52 μm and silver iodide contents of 8.0 mole %) 0.62

silver iodiobromide emulsion (with average particle size of 0.38 μm and silver iodide contents of 8.0 mole %) 0.27

sensitizing dye (SD-1) 2.3×10^{-4}

sensitizing dye (SD-2)	1.2×10^{-4}
sensitizing dye (SD-3)	1.6×10^{-5}
sensitizing dye (SD-4)	1.2×10^{-4}
cyan coupler (C-1)	0.15
cyan coupler (C-2)	0.18
colored cyan coupler (CC-1)	0.030
DIR compound (D-1)	0.013
high boiling point solvent (Oil-1)	0.30
gelatin	0.93
Layer 5: third red sensitive layer	
silver iodobromide emulsion (with average particle size of 1.00 μm and silver iodide contents of 8.0 mole %)	1.27
cyan coupler (C-2)	0.12
colored cyan coupler (CC-1)	0.013
high boiling point solvent (Oil-1)	0.14
gelatin	0.91
Layer 6: intermediate layer	
compound (SC-1)	0.09
high boiling point solvent (Oil-2)	0.11
gelatin	0.80
Layer 7: first green sensitive layer	
silver iodobromide emulsion (with average particle size of 0.38 μm and silver iodide contents of 8.0 mole %)	0.61
silver iodobromide emulsion (with average particle size of 0.27 μm and silver iodide contents of 2.0 mole %)	0.20
sensitizing dye (SD-4)	7.4×10^{-5}
sensitizing dye (SD-5)	6.6×10^{-4}
magenta coupler (M-1)	0.18
magenta coupler (M-2)	0.44
colored magenta coupler (CM-1)	0.12
high boiling point solvent (Oil-2)	0.75
gelatin	1.95
Layer 8: second green sensitive layer	
silver iodobromide emulsion (with average particle size of 0.59 μm and silver iodide contents of 8.0 mole %)	0.87
sensitizing dye (SD-6)	1.6×10^{-4}
sensitizing dye (SD-7)	1.6×10^{-4}
sensitizing dye (SD-8)	1.6×10^{-4}
magenta coupler (M-1)	0.058
magenta coupler (M-2)	0.13
colored magenta coupler (CM-2)	0.070
DIR compound (D-2)	0.025

DIR compound (D-3)	0.002
high boiling point solvent (Oil-2)	0.50
gelatin	1.00

Layer 9: third green sensitive layer

silver iodobromide emulsion (with average particle size of 1.00 μm and silver iodide contents of 8.0 mole %)	1.27
sensitizing dye (SD-6)	9.4×10^{-5}
sensitizing dye (SD-7)	9.4×10^{-5}
sensitizing dye (SD-8)	9.4×10^{-5}
magenta coupler (M-2)	0.084
magenta coupler (M-3)	0.064
colored magenta coupler (CM-2)	0.012
high boiling point solvent (Oil-1)	0.27
high boiling point solvent (Oil-2)	0.012
gelatin	1.00

Layer 10: yellow filter layer

yellow colloidal silver	0.08
color stain preventing agent (SC-2)	0.15
formalin scavenger (HS-1)	0.20
high boiling point solvent (Oil-2)	0.19
gelatin	1.10

Layer 11: first blue sensitive layer

silver iodobromide emulsion (with average particle size of 0.38 μm and silver iodide contents of 8.0 mole %)	0.22
silver iodobromide emulsion (with average particle size of 0.27 μm and silver iodide contents of 2.0 mole %)	0.03
sensitizing dye (SD-9)	4.2×10^{-4}
sensitizing dye (SD-10)	6.8×10^{-5}
yellow coupler (Y-1)	0.75
DIR compound (D-1)	6.8×10^{-5}
high boiling point solvent (Oil-2)	0.30
gelatin	1.20

Layer 12: second blue sensitive layer

silver iodobromide emulsion (with average particle size of 0.59 μm and silver iodide contents of 8.0 mole %)	0.30
sensitizing dye (SD-9)	1.6×10^{-4}
sensitizing dye (SD-11)	7.2×10^{-5}
yellow coupler (Y-1)	0.10
DIR compound (D-1)	0.010
high boiling point solvent (Oil-2)	0.046
gelatin	0.47

Layer 13: third blue sensitive layer

silver iodobromide emulsion (with average particle size of 1.00 μm and silver iodide contents of 8.0 mole %) 0.85

sensitizing dye (SD-9)	7.3×10^{-5}
sensitizing dye (SD-11)	2.8×10^{-5}
yellow coupler (Y-1)	0.11
high boiling point solvent (Oil-2)	0.046
gelatin	0.80

Layer 14: second protective layer

silver iodobromide emulsion (with average particle size of 0.08 μm and silver iodide contents of 1.0 mole %) 0.40

UV absorbent (UV-2)	0.026
UV absorbent (UV-2)	0.013
high boiling point solvent (Oil-1)	0.07
high boiling point solvent (Oil-3)	0.07
formalin scavenger (HS-1)	0.40
gelatin	1.31

Layer 15: protective layer

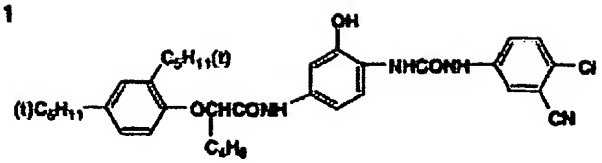
alkali soluble matting agent (with average particle size of 2 μm) 0.15

polymethyl methacrylate (with average particle size of 3 μm) 0.04

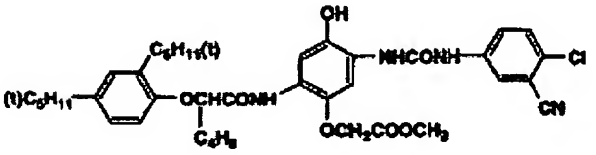
slipping agent (WAX-1)	0.04
gelatin	0.55
Su-1	0.02
Su-2	0.03
H-1	0.024
H-5	0.046
H-9	0.010

[0071] [Chem 1]

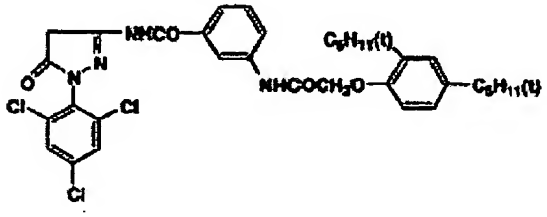
C－1



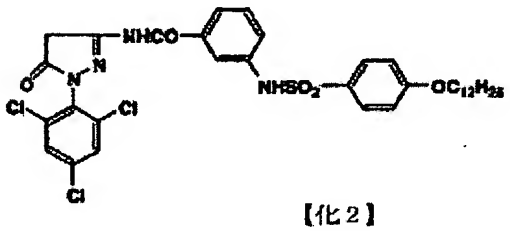
C－2



M－1



M－2



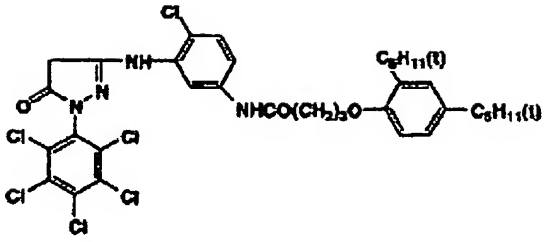
7 2】

【化２】

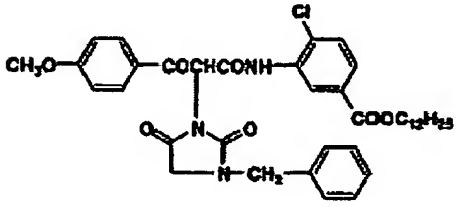
[0072]

[Chem 2]

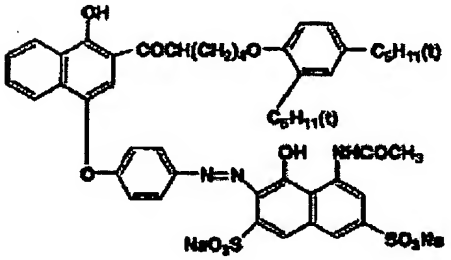
M－3



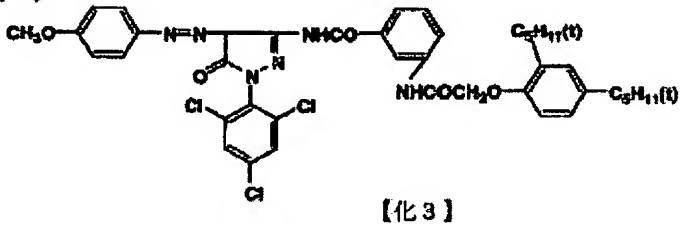
Y－1



CC－1



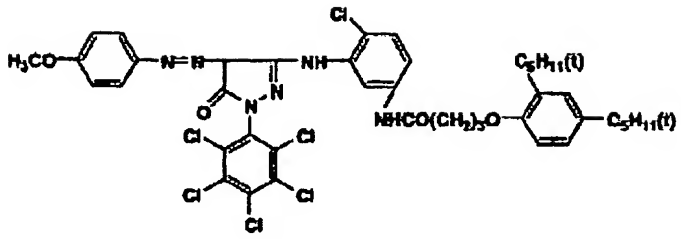
CM－1



【化３】

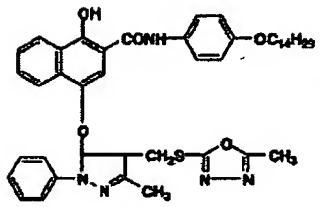
[0073] [Chem 3]

CM－2

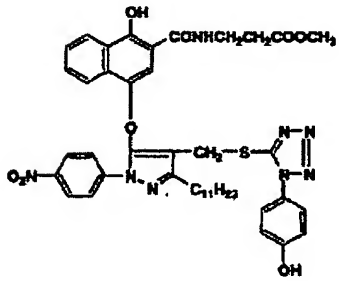


[0074]
[Chem 4]

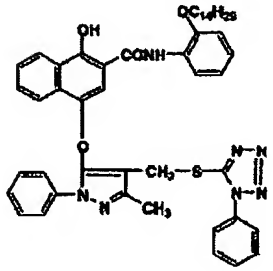
D－1



D－2



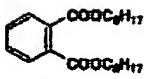
D－3



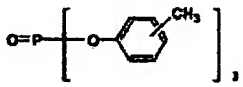
【００７５】
【化５】

[0075]
[Chem 5]

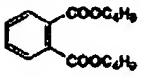
Oil－1



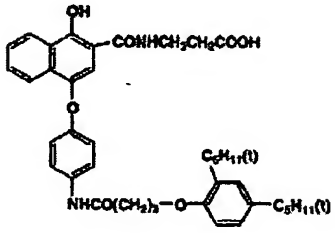
Oil－2



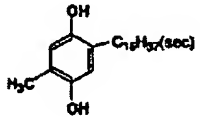
Oil－3



SC－1



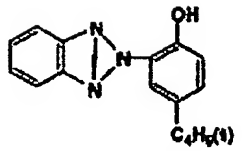
SC－2



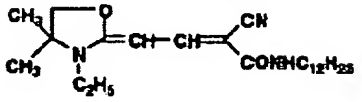
【００７６】
【化６】

[0076]
[Chem 6]

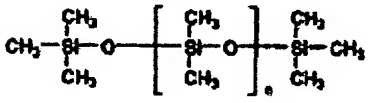
UV−1



UV−2

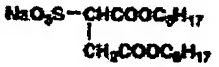


WAX−1

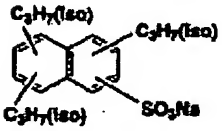


重量平均分子量 MW:3,000

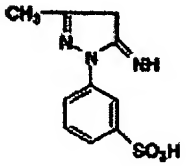
Su−1



Su−2



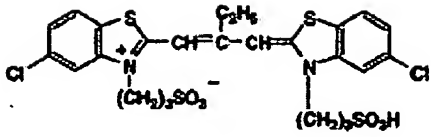
HS−1



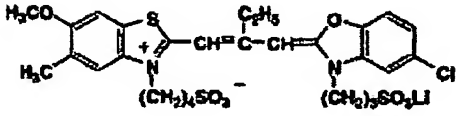
WAX-1 weight average molecular weight MW: 3,000

[0077]
[Chem 7]

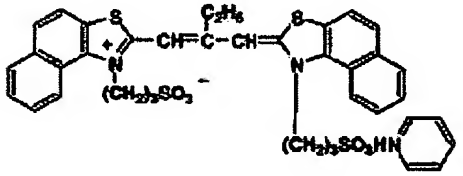
SD－1



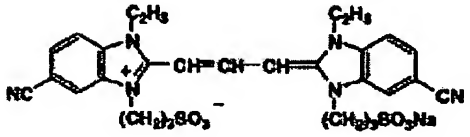
SD－2



SD－3

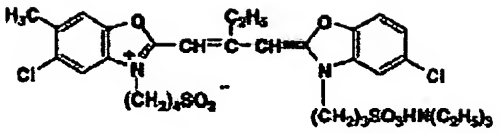


SD－4

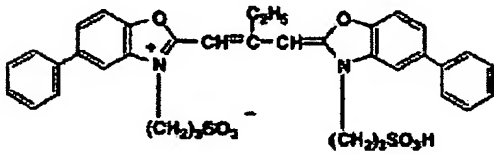


[0078]
[Chem 8]

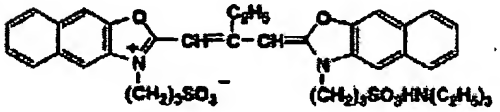
SD－5



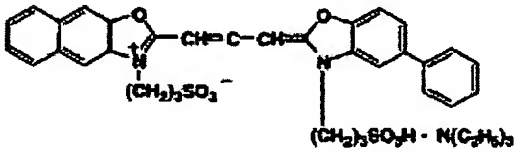
SD－6



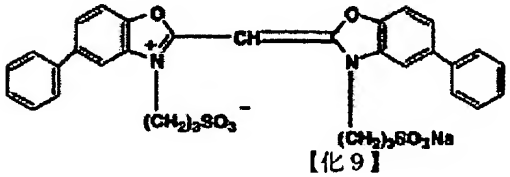
SD－7



SD－8



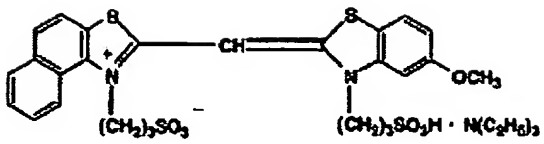
SD－9



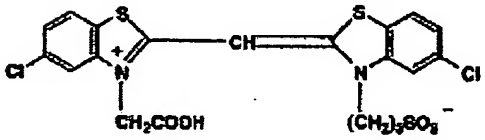
【化９】

[0079] [Chem 9]

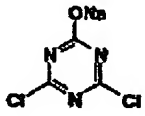
SD-10



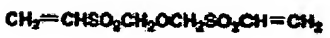
SD-11



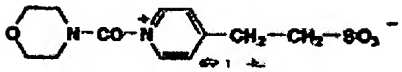
H-1



H-5



H-9



[0080] Example 1

The coating property, carrier unevenness nonuniformity, and vertical nonuniformity were observed of the photosensitive material obtained by coating and drying various coating solutions shown in Table 1 under the following conditions and using a coating solution containing 6 % gelatin and 7 %.

[0081] The gelatin concentration is varied by varying the coated wet film thickness.

[0082]

coating device	slide curtain coating device, slide bead coating devicer
coating rate	150 m/min
transporting means immediately after coating	rollers, width-wide belt
wrap angle	5 degrees ~90 degrees
carrier	cellulose triacetate film
carrier film thickness	120 μm
coated film thickness (wet)	220 μm, 245 μm, 270 μm

[0083] [Table 1]

粘度構成 cP		実験例 1	実験例 2	実験例 3	比較例 1	比較例 2	比較例 3	比較例 4
保護層		50	20	530	20	20	20	530
第2青感性層		50	200	750	200	200	50	850
第1青感性層		50	250	800	250	250	50	900
黄色フィルタ層		50	300	850	300	300	50	850
第2緑感性層		50	200	600	200	200	50	1100
第1緑感性層		50	200	700	200	200	50	900
中間層		50	300	1000	300	300	50	1200
第2赤感性層		50	500	1500	500	500	50	1500
第1赤感性層		50	600	1200	600	600	50	1350
ハレーション防止層(最下層)		50	100	250	40	320	40	250
他層算術平均		50	286	881	286	286	47	1020
スライド	塗り付け性	○	○	○	○	×	○	×
カーテン	支持体凹凸ムラ	○	○	○	×	−	×	−
塗布	横段状ムラ	○	○	○	○	−	×	−
スライド	塗り付け性	△	×	×	○	×	△	×
ビード	支持体凹凸ムラ	○	−	−	×	−	×	−
塗布	横段状ムラ	○	−	−	○	−	×	−

column 1: viscosity configuration protective layer second blue sensitive layer first blue sensitive layer yellow filter layer second green sensitive layer first green sensitive layer intermediate layer second red sensitive layer first red sensitive layer halation preventive layer (lowest layer) other layer arithmetic average slide curtain coat slide curtain coat
column 2: coating property carrier unevenness nonuniformity vertical nonuniformity coating property carrier unevenness nonuniformity vertical nonuniformity
column 3: Example 1
column 4: Example 2
column 5: Example 3
column 6: Comparative example 1
column 7: Comparative example 2
column 8: Comparative example 3
column 9: Comparative example 4

[0084] It has been confirmed from the results that as shown in Table 1, very good coating property can be obtained when a slide curtain coating device is used as compared with the case of using a slide bead coating device in all three points of the above-said observed items.

[0085] However, the results were not good with either coating device used in Comparative examples 1 ~ 3, in which the viscosity of the coating solution forming the lowest layer is not 50 cP~ 300 cP and in Comparative example 4, in which the arithmetic average of other layers is not 50~1,000 cP even though the above-said other conditions had been satisfied.

[0086] In addition, vertical nonuniformity occurred in Example 1~Example 3 when the gelatin concentration of the coating solution for forming the lowest layer was made to be 4.5 %.
[0087] In addition, carrier unevenness nonuniformity occurred in Examples 1~3 when the coated film thickness was made to be 275 μm.
[0088] When the wrap angle of the carrier with respect to the rollers was varied by adjusting the carrier tension and the sunctioning force by the suctioning device, coating unevenness of pitches of several mm ~ several tens of mm extending in the carrier transported direction occurred, and the carrier could not be transported when the said angle exceeded 90 degrees.
[0089] When one of the rollers was switched with a crown roller immediately after coating in the case of the wrap angle of 2 degrees, coating unevenness decreased to a practically harmless level. In addition, when this number was increased to 5 rollers, coating unevenness decreased further. Similar results were obtained with reverse crown rollers.
[0090] In addition, good results without coating unevenness were obtained when a tenter was used with a wrap angle of 0 degree.
[0091] In addition, when a belt was used as a transporting means, coating unevenness did not occur.
[0092] Example 2
The coating property, carrier unevenness irregularity, and vertical nonuniformity were observed of the photosensitive material obtained by coating each coating solution of the viscosities shown in Table 2 simultaneously under the following conditions, using coating solutions with the gelatin concentrations adjusted at 5.5 % and 8 %.
[0093] The gelatin concentration was varied by varying the coated wet film thickness.
[0094]

coating device	slide curtain coating device, slide bead coating device
coating rate	230/min
transporting means immediately after coating	rollers, width-wide belt
wrap angle	5 degrees ~ 90 degrees
carrier	cellulose triacetate film
carrier film thickness	120 μm
coated film thickness (wet)	250 μm

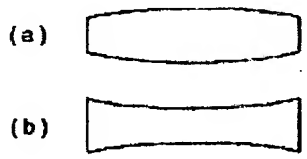
[0095] [Table 2]

粘度構成 cP		実験例 1	実験例 2	実験例 3	比較例 1	比較例 2	比較例 3	比較例 4
保護層		50	20	530	20	20	20	530
第２保護層		50	200	750	200	200	50	850
第３青感性層		50	250	800	250	250	50	900
第２青感性層		50	300	850	300	300	50	850
第１青感性層		50	200	600	200	200	50	1100
黄色フィルタ層		50	200	700	200	200	50	900
第３緑感性層		50	300	1000	300	300	50	1200
第２緑感性層		50	500	1500	500	500	50	1500
第１緑感性層		50	600	1200	600	600	50	1350
中間層		50	500	1250	500	500	50	1250
第３赤感性層		50	200	1000	200	200	50	1200
第２赤感性層		50	300	1500	300	300	50	1500
第１赤感性層		50	700	1200	700	700	50	1350
中間層		50	800	650	800	800	50	1250
ハレーション防止層(最下層)		50	100	250	42	320	40	250
他層算術平均		50	362	966	362	362	47	1124
スライド	塗り付け性	○	○	○	○	×	○	×
カーテン	支持体凹凸ムラ	○	○	○	×	−	×	−
塗布	横段状ムラ	○	○	○	○	−	×	−
スライド	塗り付け性	△	×	×	○	×	△	×
ビード	支持体凹凸ムラ	○	−	−	×	−	×	−
塗布	横段状ムラ	○	−	−	○	−	×	−

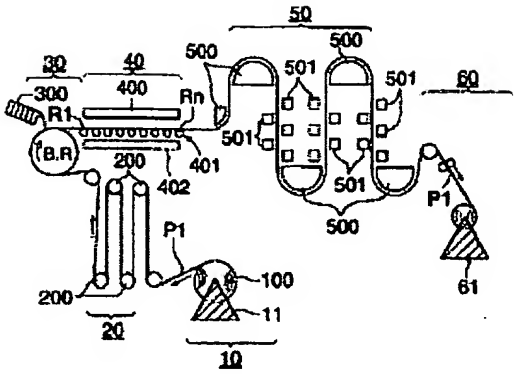
column 1: viscosity configuration protective layer second protective layer second blue sensitive layer third blue sensitive layer second blue sensitive laye first blue sensitive layer yellow filter layer second green sensitive layer first green sensitive layer intermediate layer third green sensitive layer second green sensitive layer first green sensitive layer intermediate layer third red sensitive layer second red sensitive layer first red sensitive layer intermediate layer halation preventive layer (lowest layer) other layer arithmetic average slide curtain coat slide curtain coat
column 2: coating property carrier unevenness nonuniformity vertical nonuniformity coating property carrier unevenness nonuniformity vertical nonuniformity
column 3: Example 1
column 4: Example 2
column 5: Example 3
column 6: Comparative example 1
column 7: Comparative example 2
column 8: Comparative example 3
column 9: Comparative example 4

[0096] As shown in Table 2, results similar to those of the above-said example 1 were obtained.
[0097] In addition, vertical nonuniformity occurred when the geletain concentration of the coating solution for forming the lowest layer was made to be 3.5 % and 4.6 % in Example 1 and Example 2.
[0098] In addition, carrier unevenness nonuniformity occurred when the coated film thickness was made to be 280 μm in Examples 1 ~ 3.
[0099]
[Effects of invention] Stably coated photosensitive material can be obtained even when a carrier having unevenness of about 10 μm or when a carrier that easily produces unevenness immediately after coating such as cellulose triacetate is used as the carrier.
[Brief explanations of figures]
[Figure 1] is a diagram outlining the entirety of the photosensitive producing device.
[Figure 2] is a diagram outlining in magnification a part of the rollers (transporting means) of this invention and its relationships with the carrier.
[Figure 3] is a diagram showing a crown roller and a reverse crown roller.
[Explanation of symbols]
10 supplying part
20 accumulator
30 coating part
40 setting part
50 drying part
60 rolling part
100 stock roll
200 transporting rollers
300 curtain coating device
400 cool air generator
401 transporting device
402 suctioning device
500 reverser
501 floater

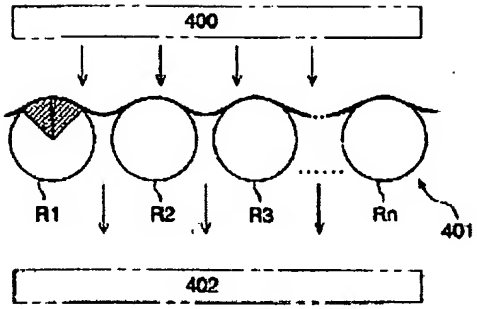
[Figure 3]



[Figure 1]



[Figure 2]



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F terms (references) 2H023 EA00 EA01 EA03 EA04
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